

*Sixty days from filing date*

23. (New) A composite film according to claim 20, wherein  
the atomic % of the at least one metal in terms of total atomic % of  
the composite film is less than 4 atomic %.

**REMARKS**

Initially, it is noted that the present action and the restriction requirement made in Paper No. 8 identify the claims of the application as claims 1-12. However, claims 13-19 were added to the application in the Preliminary Amendment filed with the application on May 8, 2001. Claims 13-19 are directed to the subject matter of non-elected Group II.

Claims 1-19 have been cancelled and new claims 20-23 have been added to the application.

Claim 20 recites the composite film of the invention as comprising:

amorphous hard carbon composed mainly of carbon and hydrogen, and containing a carbide and an oxide of at least one metal, characterized in that atomic % of the at least one metal of the carbide is greater than that of the at least one metal of the oxide.

Claim 21 recites that the at least one metal is selected from Si, Ti, B and W. Claim 22 recites that the carbide is SiC and that the oxide is  $\text{SiO}_x$ . Claim 23 recites that the atomic % of the at least one metal in terms of total atomic % of the composite film is less than 4 atomic %.

Claim 20 is inherently supported and claims 21-23 are supported by the following descriptions of the invention in the specification disclosure (where emphasis has been added):

"A metallic element, such as Si, Ti and W, which easily forms stable carbide, is added into the amorphous hard carbon films." (Page 6, lines 12-14).

"Regarding the bonding state of elementary silicon in the film, it is bonded with carbon and forms stable carbides." (Page 7, lines 9-10).

"The trace amount of oxygen is bonded with the metal element, which is not yet fixed by carbon in the form of stable carbide. The resultant oxide is in a stable bonding state." (Page 7, lines 21-23).

"The amorphous hard carbon film according to the present invention involves the concept described above and exhibits both low friction property attributable to the graphite structure and high hardness property attributable to the diamond structure and the Si-C bond. In addition, the film according to the present invention exhibits stable low frictional property attributable to the stable bond structure due to the addition of trace oxygen." (Page 7, lines 28-33).

"The silicon content is 4 atomic % or less and mainly bonded with carbon to form the Si-C bond. A part of silicon is bonded with oxygen and is in the form of  $\text{SiO}_x$ ". (Page 8, lines 1-4).

These descriptions show that in the formation of the amorphous hard carbon film, the metal added into the film preferentially combines with the carbon to form metal carbide and that oxygen added to the film combines with the metal that is not fixed by the carbon to form metal oxide. These descriptions and the description

on page 8 that in the film of the invention shown in Fig. 11, the silicon content is 4 atomic % or less and is mainly bonded with carbon to form a Si-C bond supports the limitation in claim 20 that the atomic % of the at least one metal of the metal carbide is greater than that of the at least one metal of the metal oxide. This limitation is further supported by the data of Table 1. In Table 1, the total Si is 2.55 atomic %. The oxygen is 1.01 atomic %. If all oxygen is bonded with silicon to form  $\text{SiO}_2$ , atomic % of silicon bonded with oxygen is  $1.01/2 = 0.505$  atomic %. Si bonded with carbon is  $2.55 - 0.505 = 2.045$  atomic %.

Claims 20-23 are believed to be patentable under 35 U.S.C. § 102 and 35 U.S.C. § 103(a) over the prior art. Specifically, claims 20-23 avoid the 35 U.S.C. § 102 rejections made in the action for the reasons described below.

Schmidt et al. (U.S. Patent No. 5,266,409) discloses a carbon, oxygen, hydrogen and silicon containing material. However, Schmidt et al. fails to describe the quantities and bonding states of oxygen and silicon.

Dorfman et al. (U.S. Patent No. 5,352,493) and Neerinck et al. ("Diamond like...tribological applications") also disclose carbon,

oxygen, hydrogen and silicon containing material. However, in these references, silicon is mostly bonded with oxygen to form an Si-O bond rather than an Si-C bond. Note, for example, the abstract of Dorfman et al.:

"The present invention relates to the formation of a class of nanocomposite amorphous materials consisting of interpenetrating random networks of predominantly sp<sup>3</sup> bonded carbon stabilized by hydrogen, glass-like silicon stabilized by oxygen and..." (Emphasis added).

The role of oxides and effectiveness of the present invention are also different from those of the cited references.

The cited references do not disclose a composite film within the scope of new claim 20 within the meaning of 35 U.S.C. § 102. Removal of the 35 U.S.C. § 102 rejections is believed to be in order and is respectfully solicited.

The foregoing is believed to be a complete and proper response to the Office Action dated November 6, 2003, and is believed to place this application in condition for allowance. If, however, minor issues remain that can be resolved by means of a telephone interview, the Examiner is respectfully requested to contact the undersigned attorney at the telephone number indicated below.

PATENT APPLN. NO. 09/850,192  
RESPONSE UNDER 37 C.F.R. § 1.111

PATENT  
**NON-FINAL**

In the event that this paper is not considered to be timely filed, applicant hereby petitions for an appropriate extension of time. The fee for any such extension may be charged to our Deposit Account No. 111833.

In the event any additional fees are required, please also charge our Deposit Account No. 111833.

Respectfully submitted,

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